Comments on:

Draft Problem Formulation for Ecological Risk Assessment at Operable Unit 3, Libby Asbestos Superfund Site, February 22, 2008

By:

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GENERAL COMMENTS

The Draft Problem Formulation for Ecological Risk Assessment at Operable Unit 3 (OU3) is organized and well written. We generally agree with many aspects of the ecological conceptual site model (CSM) and management goals for the Site, including the protection of populations of aquatic receptors and terrestrial avians and mammals. However, the assessment approaches and methods that are proposed tend to be presumptive that adverse ecological impacts have occurred at OU3, and these approaches and methods have many attributes of an ecological validation study which is performed after the potential for ecological impacts has been demonstrated. For example, the strategy for assessing risks to aquatic receptors includes aquatic toxicity testing on surface water samples collected from multiple locations at OU3; collection of fish from the Site and reference areas for tissue burden analysis and histopathological effects; and population and community demographic observations. We estimate that, the aquatic toxicity testing, as described, will cost in excess of $100,000. In addition, at least one of the locations proposed for surface water sampling and aquatic toxicity testing is an area of the Tailings Pond that freezes over during winter and is therefore unable to support year-round aquatic life. It is premature to conduct any aquatic toxicity testing until it is determined which ponds are capable of supporting aquatic life year-round. This is only one of five receptor groups proposed for similar levels of evaluation. Performance of all of the proposed field and laboratory evaluations for aquatic receptors, plants and soil invertebrates, amphibians, and terrestrial birds and mammals, as described, will most likely cost between $500,000 to $1,000,000, or more. In our opinion, no consideration has been given to the value of the information to be collected, or the most efficient use of limited resources.

An alternative to the performance of toxicity testing, population surveys, and site-specific studies of biomarkers of exposure run in parallel, is to perform an iterative, tiered approach to the ecological risk assessment. This approach would entail a step-wise evaluation of the potential for ecological risks, and methods would become increasingly more focused as the potential for ecological impacts is demonstrated. For example, the first step in the assessment of potential risks to aquatic receptors could entail the performance of population and community demographic surveys on the primary watershed of concern, Rainy Creek. Field collection of aquatic species inhabiting Rainy Creek downstream of OU3 by the University of Montana in 2000 demonstrated that fish, including westslope cutthroat trout, are common residents of this watershed. More

detailed population and demographic studies on Rainy Creek, and a suitable reference stream, could be used as a first-line of evidence to establish whether or not populations of fish within this watershed are at risk from exposure to Libby Amphibole (LA) or other contaminants. If populations of fish within Rainy Creek are not significantly different than populations in the reference stream, then the management goal has been met and no further studies are warranted. Alternatively, if populations of fish in Rainy Creek *are* significantly lower than populations in the reference stream, then more focused aquatic studies could be designed and conducted to determine an aquatic threshold, or adverse effect level, for LA or other contaminants. This approach would provide for a much more efficient and cost-effective use of limited resources, and allow the risk assessment to focus on those receptor groups that are at maximal risk from exposure to LA or other contaminants.

In the event that aquatic toxicity testing is recommended based on results of a population and demographic survey of fish populations within lower Rainy Creek, we propose toxicity testing on rainbow trout exposed to laboratory-prepared solutions of LA collected from OU3. A significant quantity of LA for use in toxicity testing could easily be obtained from one of the ponds (e.g., Mill Pond or the Tailings Pond) via a pump and filter system or from USGS Libby Mine LA samples. The LA would then be used in the preparation of six test solutions representative of the range of LA concentrations measured in surface water samples collected during the spring and summer 2008 sampling events. In our judgment, this method would (1) alleviate the need to collect and transport six large volumes of refrigerated water to the laboratory; (2) provide Site-specific LA for use in aquatic toxicity testing; and (3) result in the most meaningful dose-response curve for LA over the range of appropriate and representative concentrations.

Finally, the ecological problem formulation fails to acknowledge that the geologic formation (i.e., the underlying resource that prompted development of Libby Mine) is naturally high in LA-containing vermiculite. As a result, natural weathering, erosion and surface water runoff from surface outcrops have most likely contributed to concentrations of LA in soil and sediment at the Site. Statements in the document such as "...LA was detectable in a number of soil samples collected relatively close to the mined area, but was not detectable at a distance more than 1.5 miles from the mined area" are potentially misleading and fail to acknowledge natural contributions to LA at the Site. Furthermore, it is possible that populations of ecological receptors inhabiting OU3, including burrowing and below soil surface dwelling animals, have developed adaptations to naturally high levels of LA that would not be reflected in results of toxicity testing performed on laboratory species that have never been exposed to LA. These issues support the benefits of performing an iterative, step-wise approach to the ecological risk assessment, including the performance of site-specific population and demographic surveys.

SPECIFIC COMMENTS

Section 2.4.1, page 10: Tree Bark, Forest Soil and Duff, third paragraph. When will results of the tree bark and duff samples be available?

Section 2.4.1, page 10: The statement, "...LA was detectable in a number of soil samples collected relatively close to the mined area, but was not detectable at a distance more than 1.5 miles from the mined area" is potentially misleading. This statement fails to acknowledge natural contributions to LA at the Site, and should be clarified.

Section 3.4, page 16, Fish: Text states that fish may be exposed to asbestos in surface water, sediment and aquatic food items via ingestion. Figure 3-2 indicates that such exposures are believed to be complete and may provide an important contribution to the total risk to these receptors. What evidence is there to suggest that LA may pose a significant risk to fish through the ingestion pathway? This pathway would require gastrointestinal absorption of asbestos by fish. What evidence is there to suggest that LA is bioavailable through the oral route of exposure in fish? No studies are cited in Attachment D, Asbestos Profile, Section 4.0, Fish that directly address asbestos exposure through ingestion. In the absence of such evidence, the ingestion pathway should be indicated as incomplete or "?" in Figure 3-2, rather than "...may provide an important contribution to the total risk to the receptor." This qualitative statement is presumptive that LA contributes to risk to fish through the ingestion pathway.

Section 3.4, page 16, Benthic Invertebrates: Text states that benthic invertebrates may be exposed to asbestos in surface water, sediment and aquatic food items via ingestion. Figure 3-2 indicates that such exposures are believed to be complete and may provide an important contribution to the total risk to these receptors. What evidence is there to suggest that asbestos may pose a significant risk for benthic invertebrates through the ingestion pathway? Again, this pathway is presumptive and assumes gastrointestinal absorption of asbestos by benthic invertebrates.

Section 3.4, page 17, Terrestrial Plants and Soil Invertebrates: Text states that soil invertebrates may be exposed to asbestos in soil by direct contact and ingestion. Figure 3-2 indicates that such exposures are believed to be complete and may provide an important contribution to the total risk to these receptors. Again, this pathway is presumptive and assumes that LA may pose a significant risk for soil invertebrates through direct contact? Studies cited in Attachment D, Asbestos Profile, Section 4.0, Soil Invertebrates describe accumulation of asbestos fibers in worms, but the potential for adverse effects is unknown. In the absence of such evidence, the direct contact pathway should be indicated as incomplete or "?" in Figure 3-2, rather than complete.

Section 3.4, page 17, Mammals and Birds: Text states that mammals may be exposed to asbestos in soils, surface water, sediment and food via ingestion. Figure 3-2 indicates that such exposures are believed to be complete and may provide an important contribution to the total risk to these receptors. Again, this pathway is presumptive and assumes that LA may pose a significant risk for mammals through prey items and the ingestion pathway? Studies cited in Attachment D, Asbestos Profile, Section 4.0, describe exposure of mammals through the ingestion pathway, but none of them demonstrated significant effects on growth, survival, or reproduction. The only potentially adverse effect noted was histopathological effects on the lung. Changes in

histopathology are difficult to link to significant effects on growth, survival, or reproduction in receptor populations. In the absence of such evidence, the ingestion pathway should be indicated as incomplete or "?" in Figure 3-2, rather than complete.

Section 4.4, page 20, 2. Site-Specific Toxicity Tests: An additional limitation of site-specific toxicity tests is that they do not account for potential behavioral and physiological adaptations of organisms living at the site which reduce exposure to contaminants or their toxicity. Please keep in mind that the site has high naturally occurring levels of LA, and receptors inhabiting this area may have adapted mechanisms to deal with this natural constituent.

Section 4.4, page 21, 3. Population and Community Demographic Observations: The general advantages and limitations of this approach have been adequately described in this section. Population studies, however, are of greater importance when little is known regarding the effects contaminants of concern can have on survival, growth, and reproduction of receptors. Assuming an appropriate reference area can be agreed upon, comparing population demographics could be the most efficient method of initially determining if receptors exposed to site contaminants have been adversely impacted.

Section 5.2, page 23, second paragraph: Text refers to additional sampling rounds in spring and summer of 2008, which will capture temporal and spatial variability of contaminant distribution in site media. Although surface water contaminant concentrations commonly vary temporally and spatially, sediment and soil contaminant levels rarely exhibit such variation. Contaminants are bound within the sediment or soil matrix and have little mobility. Consequently, multiple rounds of sediment and soil sampling may not be necessary. The additional surface water sampling is appropriate and should capture existing temporal or spatial variability within site water bodies.

Section 6.2, page 25: Text states that Step 1 of the site-specific toxicity testing process will be the collection of surface water samples from multiple on-site locations. As discussed during the February 28, 2008 meeting, the collection of surface water samples from multiple locations for toxicity testing should be deferred in preference to the preparation of a range of test solutions in the laboratory having equal weight over the range of LA concentrations observed during the spring and summer 2008 surface water sampling events. A significant quantity of LA for use in toxicity testing could easily be obtained from one of the ponds (e.g., Mill Pond or the Tailings Pond) via a pump and filter system. The LA-containing filter(s) could then be sent to an aquatic toxicity testing laboratory for back-flushing and preparation of six test solutions representative of the range of LA concentrations measured in surface water samples collected during the spring and summer 2008 sampling events. In our judgment, this method would (1) alleviate the need to collect and transport six large volumes of refrigerated water to the laboratory; (2) provide Site-specific LA for use in aquatic toxicity testing; and (3) result in the most meaningful dose-response curve for LA over the range of representative concentrations.

Section 6.2, page 25: Text states that undiluted surface water from multiple locations will be used in Step 2 of the site-specific toxicity testing. As described in the previous comment, above, we recommend preparation of a range of test solutions in the laboratory based on LA obtained from one surface water body (e.g., Mill Pond or the Tailings Pond) found to have high LA concentrations during the spring and summer 2008 surface water sampling events. Please modify the text accordingly.

Section 6.2, page 26: Text states that in Step 3b of the site-specific toxicity testing, spiking studies could be performed if no toxicity is observed using the surface water sample with the maximum detected LA concentration. During the February 28, 2008 meeting, information was presented suggesting that LA concentrations as much as an order of magnitude higher than the maximum LA concentrations detected may be used in toxicity testing. Please note that LA concentrations tested should provide good coverage of the range of LA levels detected in surface water where fish may be present at the site, in order to yield the most useful dose-response curve for assessing potential risks to fish inhabiting surface waters at OU3. This LA concentration range appears to be somewhere between 114 MFL in the Tailings Pond to <1 MFL at the confluence of Rainy Creek and the Kootenai River. This concentration range will be confirmed during the spring and summer 2008 surface water sampling events.

Section 6.2, page 26, fourth paragraph, first sentence: As discussed during the February 28, 2008 meeting in Salt Lake, we agree that conducting site-specific aquatic toxicity testing on a sample of LA obtained from OU3 may provide useful information. However, we believe that aquatic toxicity testing is premature, at this time, and should be deferred until after the spring and summer 2008 surface water sampling events are completed. We also believe that sediment toxicity testing can, and should be, deferred until the results of toxicity testing on LA in surface water is completed.

Section 6.2, page 27, Fish Community: When electro-shocking, attempts should be made to collect fish of the same species at each location in order to control for species-specific differences in measurement endpoints. If sufficient numbers of the same species cannot be collected at each location, members of the same subfamily should be harvested.

Section 6.2, page 27, In-Situ Measures of Exposure and Effects: How will a link be established between the frequency and severity of histological lesions and receptor growth, survival, and reproduction? Please describe how a correlation will be made between changes in histology and significant adverse effects on populations of fish.

Section 6.2, page 27, Gross and Microscopic Lesion:. How will a link be established between gross pathology and histological effects and receptor growth, survival, and reproduction? Please describe how a correlation will be made between changes in gross pathology and histology and significant adverse effects on populations of fish.

Section 6.3, page 28, Site-Specific Toxicity Testing: Please indicate which plant species will be used in the site-specific toxicity testing of site soils and provide evidence of its relevance to the plant communities present at the site.

Section 6.3, page 28, Site-Specific Population and Community Demographic Observations: Soil invertebrate population studies will not be performed. It is unclear if a plant community assessment is planned or is just being considered as possibly useful. If the study is planned, please provide detail regarding methodology and plant types (forbes, browse, etc.) that are proposed for characterization.

Section 6.4, page 28, first paragraph, second sentence: Text states "Although data from Phase I are not yet available...". Is this a reference to the tree bark and duff samples? Please clarify.

Section 6.4, page 29, Biomarkers of Exposure and Effect: Is the measurement of biomarkers of exposure to asbestos planned as part of this investigation? If so, please identify these biomarkers and cite references.

Section 6.4, page 31: Text references Table 6-2, Wildlife Exposed Receptor Groups. As stated in Section 3.3, page 15, feeding guild table and preceding paragraph, "If a detailed assessment of feeding guilds is needed, the most common approach is to select a representative species to represent the group." Please identify the proposed representative species for each guild shown in Table 6-2.

Section 6.4, page 31, Table of maximally exposed receptor groups: There should be some evidence that asbestos is capable of adversely impacting the prey of invertivores, herbivores, and piscivores before embarking on a costly sampling program to evaluate potential impacts at higher trophic levels. An iterative approach is recommended in which the first phase focuses on the prey groups (invertebrates, plants, fish) listed above. In addition, a worst case scenario small mammal population study should be conducted as ground invertivores are likely at a higher risk than other potentially exposed receptor groups due to their increased soil exposure.

Section 6.4, page 31, Collection Methods: Text states that mammals will be collected using Sherman live traps. In the proposed iterative approach, only small burrowing mammals should be collected in the first phase of the investigation. Sherman live traps are available in different sizes for different mammals. In our experience, only the smallest Sherman live traps will prevent smaller sized shrews from escaping through cracks in the trap. Please make sure to select the appropriate trap size for these species. The suggested worst case scenario study location is near the Tailings Impoundment. For any investigative survey area, habitat for small burrowing mammals must be present, and the area must have been impacted by mining-related activities. An appropriate reference location would need to be selected as well.

High levels of vermiculite and LA are naturally occurring in the mine area. Consequently, burrowing animals are exposed to high vermiculite and LA concentrations that are unrelated to historic mining activities in several of the proposed sampling locations. IF sampling of small burrowing mammals is conducted for tissue and/or

histopathologic analysis, sampling locations should be carefully selected to ensure that only mining-related effects are measured.

We fail to understand how birds, particularly arboreal invertivores, are likely to receive significant exposures to LA fibers. Even resident birds have large home ranges and are unlikely to forage exclusively within the areas proposed for sampling. Furthermore, the collection of birds representative of multiple receptor groups (i.e., ground invertivores, ground herbivores/omnivores, arboreal invertivores, aquatic invertivores/omnivores, and piscivores) and from multiple locations (i.e., mined, forest and riparian) is highly presumptive that exposure pathways are complete and significant. The potential for avian exposure to LA could be tested in a much more direct and less expensive manner by sampling dietary items for these receptors to determine whether or not they are exposed to significant concentrations of LA through the ingestion pathway. If dietary items fail to contain significant levels of LA, then the ingestion pathway is unlikely to be significant for birds. As described above, sampling of small burrowing mammals would provide a worst-case assessment of the potential for exposure and risk to terrestrial animals through the inhalation pathway. If exposures and risks to small burrowing mammals from inhalation are insignificant, then it is highly unlikely that birds would receive significant exposures through this pathway. Again, we believe that an iterative, step-wise approach to the ecological risk assessment is much more rationale and will provide a more efficient use of investigation resources.

Section 6.4, page 31, Measurement of Asbestos Tissue Burdens: No such measurements would be conducted for mammals or birds in the first phase of the proposed iterative approach. If such measurements were conducted, how would LA tissue burdens be correlated with effects on receptor growth, survival, and reproduction? How will LA tissue burdens be related to significant adverse effects on populations of birds and mammals?

Section 6.4, page 31, Histopathology: No such measurements would be conducted in the first phase of the proposed iterative approach.

Section 6.4, page 32, Population and Community Demographic Observations: A quantitative small mammal population survey would be conducted in the first phase of the proposed iterative approach. Additional surveys of mammalian or avian density and diversity would not be performed.

Section 6.4, page 32, Additional Toxicity Testing with LA: No such toxicity testing would be conducted in the first phase of the proposed iterative approach. There should be some evidence that LA is capable of adversely impacting the prey of invertivores, herbivores, and piscivores before embarking on toxicity testing on organisms at higher trophic levels.

Section 6.5, page 33, Site-Specific Toxicity Testing: Refer to our previous comments regarding surface water sample collection, aquatic toxicity testing, and spiking studies. The same approach should be utilized when conducting the FETAX.

Section 6.5, page 33, In-Situ Measures of Exposure and Effects: What evidence is there to suggest that LA may be associated with gross or histological abnormalities in amphibians? Given that the incidence of deformities in amphibians has increased nationwide and the contributing causal factors are not well understood, this is not an appropriate measure of site-specific impacts on amphibians. In addition, frog population demographics, in general, vary considerably both temporally and spatially. Consequently, an amphibian population study at the site and an appropriate reference area would not necessarily provide useful data for this investigation.

Section 6.5, page 33, Population and Community Demographic Observations, first paragraph: Text describes the collection of amphibians from the site, and from reference areas, "...to examine and assess the frequency and severity of gross and histological abnormalities." Aside from being presumptive that LA has contributed to adverse effects in amphibians at OU3, this section fails to identify a suitable reference location. During the February 28, 2008 meeting, a wildlife refuge was proposed by the USFWS as a reference location for the Tailings Pond. A managed wildlife refuge located distant from OU3 is unlikely to represent similar geological and biological attributes as the Site. In light of the previous comment, above, regarding natural variability in amphibian populations, as well as the availability of a suitable reference location, the appropriateness of a population and demographic survey for amphibians at the Tailings Pond should be further evaluated.